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DOI:
10.1136/acupmed-2015-011042

Document Version
Peer reviewed version

Citation for published version (Harvard):
Clark, M, Clark, R, Toohey, S & Bradbury-Jones, C 2017, 'Rationales and treatment approaches underpinning the use of acupuncture and related techniques for plantar heel pain: a critical interpretive synthesis', *Acupuncture in Medicine*. https://doi.org/10.1136/acupmed-2015-011042

Rationales and treatment approaches underpinning the use of acupuncture and related techniques for plantar heel pain - a critical interpretive synthesis

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KEY WORDS
Acupuncture, Plantar Heel Pain, Plantar fasciitis, critical interpretive synthesis, patchwork

WORDCOUNT: 4193

COMPETING INTERESTS: ST offers training courses on the use of acupuncture for podiatrists and other health professionals.

FUNDING STATEMENT: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors

ABSTRACT

Background: Acupuncture shows promise as a treatment for plantar heel pain (PHP) or plantar fasciitis (PF) but data heterogeneity has undermined demonstration of efficacy. Recognising that acupuncture is a diverse field of practice, the aim of this study was to gain a broader, global perspective on the different approaches and rationales used in application of acupuncture in PHP.

Methods: We built upon an earlier systematic review (which was limited by necessity of a methodological focus on efficacy) using the critical interpretive synthesis (CIS) method to draw upon a wider international sample of (25) clinical sources, including case reports and case series. Multiple tracks of analysis led to an emergent synthesis.

Results: Findings are presented at three levels: primary (summarised data); secondary (patterns observed); and tertiary (emergent synthesis). Multiple treatments and rationales were documented but no single approach dominated. Notable contradictions emerged such as the application of moxibustion by some authors and ice by others. Synthesis of findings revealed a 'patchwork' of factors influencing the approaches taken.

Conclusions: The complexity of the field of acupuncture was illustrated through the 'lens' of PHP. The 'patchwork' metaphor provides a unifying framework for a previously divergent community of practice and research. Several directions for future research were identified, such as: importance of prior duration; existence of diagnostic subgroups; how practitioners make clinical decisions and report their findings. CIS was found to provide visibility for multiple viewpoints in developing theory and modelling the processes of 'real world' practice of acupuncturists addressing the problem of PHP.

SUMMARY POINTS

- We applied critical interpretive synthesis as an adjunct to our previous systematic review to advance knowledge on the use of acupuncture for plantar heel pain
- Many approaches have been reported globally in the use of acupuncture for plantar heel pain – no single treatment, rationale or model predominates
- A 'patchwork' model is presented, unifying previously disparate aspects and illustrating multiple factors at play in the construction of clinical knowledge
- Key questions for future research are identified
- Drawing on diversity, critical interpretive synthesis was a valuable tool for modelling and theory building

INTRODUCTION

People with plantar heel pain (PHP) commonly present to health professionals around the world.[w1-3]. Our earlier study recommended that future research should recognise the complexity of PHP, of acupuncture and of the relationship between them, to explore the optimum use and integration of acupuncture in the treatment of PHP. The accuracy of related terms such as 'plantar fasciitis' (PF) and 'calcaneal spur' has been contested. The aetiology of PHP is complex, involving the interplay of tissue, biomechanical, psychological and other factors.[1] Furthermore, although often considered to be a single 'condition' PHP is conceptualised differently in different professional contexts such as medicine, podiatry, physical/sports therapy and acupuncture.

PHP is typically characterised by pain under the heel that is worse during weight bearing, particularly in the morning and on first movement, with associated tenderness over the calcaneal tubercle. Although usually self-limiting, it can become chronic, causing substantial morbidity and a significant economic burden.[w1,w4-5] There are various approaches to treatment, including stretching, orthotics, night splints and medication. However, evidence of their effectiveness is inconclusive,[w6] compliance is often poor[w7] and interventions such as non-steroidal anti-inflammatory drugs (NSAIDs) and steroid injections carry significant risks.[w8-9]

Acupuncture represents an alternative treatment for PHP. Although not mentioned in current guidelines,[w4, w10] there is growing evidence to support its use. Our earlier systematic review (SR)[1] rigorously appraised the quality of eight comparative studies and showed that acupuncture can be effective for the treatment of PHP. However, it was not possible to make strong recommendations because of the heterogeneity of the interventions reported. Acupuncture therapy is not a single intervention but a plural field of practice.[w11-14] Acupuncturists' conceptualisations of PHP include 'myofascial pain', PF, '*Bi syndrome*', '*deficient Kidney Qi*' and others. Even the definition of acupuncture is contentious. Some define it (literally) as needles penetrating the skin; others differentiate such 'dry needling' from the use of classical Chinese concepts. Similarly, some stress the importance of context, seeing acupuncture as part of a 'whole system' of practice.[w15-16]

Hence while it is desirable to assess the effectiveness of acupuncture for PHP, the question of whether or not acupuncture is efficacious for heel pain' is oversimplified.[1] Some have called for Whole Systems Research (WSR)[w17-18] with 'model validity' and a 'paradigm fit' to embrace approaches such as Traditional Chinese Medicine (TCM) but even this is problematic because delimiting a 'whole system' is not straightforward (and many acupuncturists embrace multiple models).

We felt it was important to stand back and gain a broader perspective of the complexity of acupuncture with the aim of "identifying and developing theory, and modelling processes"[w19] that may better reflect the diversity of 'real world' practice. The aim of this study was to explore the diversity of the available relevant literature and to determine what approaches and rationales are used when applying acupuncture to PHP by way of a critical interpretive synthesis (CIS).

METHODS

The protocol was registered with PROSPERO (CRD42015024030).[w20] While our earlier SR[1] focused on effectiveness, with rigorous assessment of methodological quality,[w21] the current study drew on a wider range of sources (chosen for relevance rather than methodology) using CIS, a qualitative systematic review method. CIS is intended to inductively derive new concepts and theories by rigorous critical interpretation of both qualitative and quantitative data. We followed the recommendations of Bales and Gee[w22] and Dixon-Woods,[w23,w24] interpretively producing a set of categorical constructs on the whole topic, subsequently linked to our 'synthesising argument' about

acupuncture approaches for PHP. In constructing our synthesis we reflexively bracketed[w25:p136] our prior assumptions relating to the topic.

Literature selection

The initial search strategy is described in detail in our previous report.[1] Identification of relevant sources continued through 2012-14 via electronic alerts, online forums, browsing of library shelves and following up of leads from reference lists, with the aim of finding all available sources on the topic. As our aim was to gain a broader perspective, we took an inclusive approach to the types of source included, as well as to defining 'acupuncture and related techniques' and 'plantar heel pain'. Papers were included if they: reported on primary clinical reports (randomised controlled trials (RCTs), nonrandomised comparative studies, case series, and single case studies); were concerned with PHP and related conditions (calcanodynia, plantar fasciitis/fasciosis, heel spurs or calcaneal hyperosteogeny); described the use of acupuncture, acupuncture points, TCM, Oriental medicine (OM) or moxibustion; described the use dry needling of myofascial trigger points (MTrPs), whether or not an acupuncture-related rationale was used; described the use of other interventions (laser therapy, mini-scalpel needle) provided that the treatment was applied specifically to acupuncture points; or if an acupuncture-related rationale was used. Papers were excluded if they were: secondary reports; related to pain secondary to other defined pathologies; or related to experimental pain or animal subjects. Three papers were translated into English.

Analysis

As a CIS, the aim of the present review was to generate new insights, therefore quality appraisal against generic hierarchy-of-evidence methodological criteria, such as risk of bias[w26] was not deemed appropriate. The aspects of quality important to our study were: relevance to our research question; intervention reporting; and rationale reporting. The relevance of sources to our research question was determined by whether or not they satisfied our inclusion criteria. Intervention reporting was systematically examined with reference to the STandards for Reporting Interventions in Clinical Trials of Acupuncture (STRICTA) guidelines[w27] and rationale reporting via the 'levels of theoretical visibility' (LTV) model previously proposed[w25] The findings of these appraisals formed part of our iterative process of analysis.

Data were extracted, entered into a spreadsheet, coded in NVivo (qualitative analysis software) and inspected visually by means of mind-mapping, flow-charts and anatomical mapping of interventions. Data-extraction and coding was spot-checked independently. Three framework analyses were performed using STRICTA,[w27] the LTV model[w25] and a framework recommended by Price *et al.[*w18], respectively. The sources were mapped onto each other, allowing common themes, areas of similarity and aspects of difference and apparent contradiction to be noted. These comparative processes were revisited and discussed as necessary as higher order themes emerged, over an extended period. To gain additional perspectives beyond our own, preliminary findings were presented to groups of peers at conferences and local study groups. Bringing together the different 'lines of argument' allowed the emergence of a 'synthesising argument'[w23] and a theoretical framework expressing the overview that we constructed.

RESULTS

Our findings are presented at three levels: primary (summarising data from the sources); secondary (patterns emerging from the data); and tertiary (our synthesising argument and concept map). For brevity, we present only those findings most relevant to our research question. Twenty-five publications reported original clinical research or practice, and formed the core of this study (Figure 1).[2-26]

Primary findings

Our primary findings are summarised in supplementary files 1 (list of contents), 2 to 4 (for data extraction details). Web-only references are provided in supplementary file 11. As expected the 25 sources were diverse in almost every aspect (supplementary file 5). The prior duration of the presenting complaint ranged from 10 days to 30 years. One paper included only acute cases, and seven only chronic cases. Several papers[5,10,17] reported prior duration to be a particularly significant parameter, i.e. it was inversely proportional to the benefit obtained, however others[3,11,14,18] provided no data on this.

All studies used pain as the main outcome focus, however it was measured in a variety of ways. Some studies also assessed functional outcomes but none measured changes related to underlying theory, such as changes in tissue or TCM diagnostic variables (character of tongue or pulses). While all studies treated pain in the heel, they conceptualised it differently: 11 referred to PF and three to calcaneal spurs, two gave individualised TCM 'diagnoses', six referred to other pathologies in some cases, and three did not apply any diagnostic label. The basis for a diagnosis was made clear in 15 papers; others stated diagnosis was "clinical" or did not specify. Seven papers elaborated on the relevant differential diagnosis, distinguishing PHP (or PF) from systemic conditions such as rheumatoid arthritis, or from other local causes such as fractures, tumours, etc. Of the 11 papers using the label 'PF, three diagnosed it solely on the basis of the location of the pain/tenderness; only two[21,23] explicitly used conventional (Western) diagnostic criteria. Most used the terms heel pain and PF interchangeably, while one made the distinction.[15] Most asserted or assumed an inflammatory basis for PF;[2,4,9-11,15,17,18,21] one argued against it.[22] Two papers[19,21] diagnosed heel spurs based on X-ray evidence, another[18] used clinical criteria, labelling the condition 'heel spur' even when it was not objectively confirmed by X-ray. Others[2,15,22,24] noted the lack of correlation between heel spurs and pain. In contrast, some implied[7] that the presence of a heel spur was an indicator of a poorer prognosis, or requirement for stronger treatment. None of the papers reflected on the diagnostic terminology used.

In most cases stimulation of acupuncture points was by needle insertion; four studies used electroacupuncture and two papers used laser acupuncture. One paper reported the use of the 'mini-scalpel needle' (MSN) claiming that the technique was 'both acupuncture and micro-surgery'. The application of heat at *ah shi* points was reported by two papers, while others referred to the application of ice as an ancillary technique; this apparent contradiction is discussed below.

A formulaic approach (using the same points at every session, for every patient) was taken by 10 studies, while six studies took a variable, individualised approach. Looking for patterns, we found that some types of acupuncture points were used more than others (supplementary file 6). Furthermore, points were commonly used in combination with other points and the combinations chosen also varied widely (supplementary file 7). The rationales for such choices varied, even for a single point (e.g. KI3 was used as a local point, for classical indications e.g. to '*tonify Kidney Qi* or *clear Heat'*, or simply because others had reported using it). Overall a very large number of different rationales were reported, which are summarised in Table 1. Rationales were classified into groupings that emerged from the data; a fuller picture is provided in supplementary file 8. Some sources reported a single rationale to explain the approach; others integrated more than one rationale into their explanation (Table 2).

Table 1: Classification of rationales

Category	Type of rationale
Traditional East Asian Medicine (TEAM)	General Referring to the classics Meridian theory Local/distant Principle of opposites or 'upper for lower' Stagnation *Zang-fu* syndromes *Bi* syndrome Specific functions of points The 'Eight Principles'
Patho-physiological	General Myofascial (trigger points) Local vascular physiology Segmental neurophysiology (gate theory) Extra-segmental CNS physiology Hum oral, endorphins
Empirical	Citing sources included in this review Citing other sources
Pragmatic	Safety/comfort considerations *Ah shi* points Other points chosen because tender Adaptation of approaches cited Change from ineffective methods
Other	Electro-detection of points Auricular points (Nogier) New point New approach "not TCM"

Table 2: Rationale combinations

Rationale combinations	n	Sources
TEAM only	4	[2,7,9,13]
Pathophysiological only	2	[23,26]
Empirical only	1	[3]
TEAM + Pathophysiological	3	[4,12,21]
TEAM + Pathophysiological + Empirical	2	[15,17]
Pathophysiological + Pragmatic	2	[24,25]
TEAM + Pragmatic	3	[6,16]
TEAM + Pragmatic + Empirical	5	[10,11, 20,22]
TEAM + Other	1	[14]
TEAM + Other + Empirical	1	[19]
TEAM + Other + Pragmatic	1	[18]
Pragmatic + Other	1	[5]

No rationale given	1	[8]

Secondary findings

We observed, even in this relatively small body of literature, a wide variety of styles of rationalisation. A minority were entirely consistent with one model, while the majority of authors integrated a range of approaches within their practice. This integration was seen at different levels: some articulated 'Western' and 'Eastern' models in parallel but didn't integrate them, while others alternated the two (e.g. "points … chosen based on the segmental approach of needling within the dermatomes … were also chosen to reflect the meridian overlying the painful area."[12]). Others integrated at the level of point functions, ascribing physiological functions to traditional acupuncture points. Generally, treatment strategies were rationalised on the basis of traditional East Asian medicine (TEAM) plus pragmatic considerations; pathophysiological reasoning was applied in broader terms.

Authors rationalised according to earlier publications in various ways. Six papers provided no references at all, five cited classical texts to support their approach, and only nine cited earlier publications included in this study. Of the nine, two provided treatments similar to those described in the work cited but with significant changes that were not explained. The remaining seven chose very different approaches from the works cited. Similarly, five cited related articles and four cited textbooks to support their rationales, yet they did not follow the approach recommended in the original sources. For example, Zhang *et al.*[17] stated: "The protocol … was based on previous clinical reports… Participants in the treatment group received needling at the [contralateral]… PC7" and yet both publications cited used ipsilateral SI3; the reason for choosing a different point was not given.

There were also some apparent contradictions: while some authors construed the problem as inflammatory in modern pathological terms ('hot') and therefore recommended the application of cold, others saw it as 'cold' (*cold Bi* or *deficiency of Qi*) and so applied heat in the form of moxibustion or a poultice. This apparent contradiction between the biomedical and TEAM models may indicate that there are sub-types of PHP that may need different treatments. A minority of papers noted that the prior duration of PHP influenced treatment outcomes, and we would recommend that this variable be accounted for in future research. Several sources recommended treating acupuncture points on the contralateral arm (PC7, LI4, SI3, *Zhanggen*, *Guguan/Muguan*, or the "corresponding point"). Future research could build on the work of Zhang *et al.*[17] to assess relative efficacy and explore potential physiological underpinnings of these 'diagonally opposite' (DO) points.

Framework analyses

STRICTA analysis (supplementary file 9) showed that sources' quality of reporting varied from 39%[11] to 90%.[17] An extended commentary on our experience using STRICTA is presented in our linked letter to the editor.[26]

LTV analysis[w25] revealed six papers that gave detailed and consistent rationales for the intervention used.[11-13,15,16,27] All but one were studies of single cases and all took an individualised approach. Otherwise theoretical visibility was poor. Two studies offered no rationale at all.[5,8] One of them has since been cited by others, so we have the beginnings of a 'body of evidence' with an atheoretical basis. The remaining 17 studies gave some explanation, which was more or less incomplete.

In some, the theory was clearly used *a priori* to derive a strategy; in others, it read more like an afterthought – a *post hoc* justification. However, this is hard to judge and may simply reflect journalistic conventions, such as an expectation that biomedical explanations should be included, rather than the authors' own thought processes.

We analysed our sources using the model validity guide of Price *et al.*[w18], recommended for differentiating styles of acupuncture, which they refer to as traditional (TA) and medical (MA). Like Price *et al*, we found that most sources did not map neatly onto either category (supplementary file 10). There was a tendency for RCTs and case series to display characteristics from the MA column, however single case reports showed no such tendency. Similarly, no such tendency was found in relation to the style of acupuncture, practitioners' background or country of origin.

Tertiary findings

Acupuncturists' approaches to PHP were diverse in almost every respect and notions of domination by a single intervention, rationale or theoretical model were not supported by our findings. Some authors took a diagnostic approach, others a symptomatic approach. Some undertook individualised assessment based on theoretical underpinnings (usually a mixture of TEAM and biomedical ideas) leading to bespoke interventions. Others chose a single acupuncture point as their treatment for PHP, thus demonstrating a belief in fixed acupuncture points with predictable functions. Some offered empirical or theoretical support for this but others were atheoretical. Yet others were pragmatic, choosing points on the basis of tenderness (sometimes influenced by theoretical constructs, such as MTrPs, meridian or segmental neurophysiology, but often atheoretically, particularly *ah shi* points). Some referred to earlier publications but modified the recommended approaches without explanation. Most practitioners didn't adhere to single explanatory models but were more 'post-modern'[w28] in their approaches. The use of a single model (e.g. in RCTs) may be an expectation of the research community[w18] but, free from such constraints, individual case reports reflect practice that is more eclectic and flexibly individualised.

Our synthesis crystallised while we grappled with how to report these variable practices. We think it could be described as a "real patchwork" and reflecting on this phrase allowed us to sense the value of this metaphor. It represents how the acupuncture community creates knowledge, which is perhaps different from our usual understandings.[w18] We see practitioners constructing knowledge differently in differing contexts, under a variety of influences, including theory. Figure 2 illustrates our attempt to model this, with each 'patch' representing an aspect of the studies, with several variants around it. The dates and countries illustrate the range of this study. This image is an aesthetic representation of a process, rather than a comprehensive catalogue of variables. We represented 12 aspects, each with four variables, because this was easy to draw – a better image would arguably have been a quilt made up of fragments of various sizes and shapes, with combinations varying in different contexts. The implications of this metaphor are discussed below.

DISCUSSION

Treatment of PHP represents a minute fraction of acupuncture practice yet, even viewed through such a small lens, acupuncture can be seen to be immeasurably complex. The heterogeneity of patients and practitioners, and the relationships between them, ought not to be considered an inconvenience to researchers, to be neutralised by subject selection and procedure standardisation. Rather it is the nature of the phenomena under study. This clinical diversity may be compared to genetic diversity, or the ecological complexity of a forest; vitally important, yet easily overlooked by adopting a narrow focus.

The diversity of our findings is unsurprising, as our sources spanned three decades and four continents. The practice of acupuncture has evolved in different ways during its journey around the globe. Similarly, explanations of PHP have evolved from notions of bone spurs or inflammation towards biomechanical explanations, including MTrPs.

However, the acupuncture discourse on PHP is notably ahistorical and without a unifying 'research tradition'.[w30] Our emergent 'patchwork' model led us to Flannery's excellent

discussion[w29] of quilting as a useful metaphor for science – which may represent a way of moving towards a shared understanding of how the use of acupuncture for PHP might be optimised. Flannery notes that “most metaphors describing science are distinctly masculine in tone, such as: exploring, hunting, or penetrating the unknown… [and] have had a powerful effect on how science is done, but a feminist view of science brings with it a need for new metaphors with less aggressive and alienating connotations that will reduce the gap between science and other parts of our culture” – such as clinical practice, perhaps.

Reflecting on our data from Flannery’s perspective highlights values not represented in this body of acupuncture research. There is value in creating an aesthetic, functional whole from disparate elements, which may involve iterative processes of co-creation and reworking. ‘Silence’ is valued by attending contemplatively to the patient and their physical and emotional responses (rather than imposing a ‘proven’ intervention). Similarly ‘touch’ may be valued by acknowledging the importance of therapeutic touch (c.f. instrumental touch), the tacit knowledge of the expert practitioner and the artistry of its application. We can also note the value of ‘community’ – our written sources are co-created by the authors, reviewers and publishers; knowledge in the field is co-constructed. Finally, we can acknowledge ‘loose ends’ – our reflexive process makes us very aware of these, and aware that much is ‘not said’ in the publications we studied.

This opens up a range of possibilities for future practice and research. Practitioners may be empowered by awareness of the wide range of possible approaches, although some may need to undertake further training to make the most of this. While some have criticised this syncretic approach as ‘mongrel medicine’[w31] we prefer to anticipate the advantages of hybrid vigour.

Researchers may note some simple technical questions arising from our analysis, for example how outcomes may be influenced by prior duration of the complaint, whether there are different subgroups with and without MTrPs and/or needing heat/cold treatment, whether there a physiological underpinning/explanation for use of tender and/or DO points. The answers to these questions could inform clinical decision making. Meanwhile broader questions remain, such as how practitioners choose between the various approaches, in different contexts, whether practitioners base their approaches on diagnostic models and, if so, which, whether it is possible to design a protocol to optimise treatment decisions, and how knowledge may be constructed differently in the clinical context and research context.

A patchwork of research methods will be needed to address these questions and the way forward will be the subject of a further paper. We are not putting forward suggestions for assessing efficacy. We started out thinking that a reductionist focus on acupuncture was premature and needed to be preceded by model-building and theorising. Our synthesis of current knowledge in the field suggests that this is still the case but now we have a new perspective to enable us to bridge the theory-practice gap – the patchwork perspective.

Reflections on this study

Our team embodies widespread expertise: classical and modern acupuncture practice, teaching and research (RJC, ST); transnational aspects of practice (MTC); methodology and theory (MTC, CB-J). Our professional identities have collectively shaped our interpretations and a different team may have gathered different insights. However, the potential for bias from a narrow practitioner perspective is reduced by the contribution of diverse theoretical inputs.

Some potentially useful sources were not included: several Chinese publications were identified but unobtainable; our pragmatic focus on primary clinical work excluded theoretical input from books, journals and the internet; and, importantly, the wisdom of

many practitioners is unavailable because they have not chosen to express themselves in writing. We studied only published work, thus privileging ‘propositional knowledge’; the ‘tacit knowledge’ that is so important in practice is very much under-represented here.

Our study area is narrowly specialised and our sample, although comprehensive (apart from the few unobtainable papers), was small in size. However, clinical experience has led us to believe that our findings offer insight into how acupuncturists think, which may be relevant in wider clinical contexts.

This CIS complements our earlier SR.[1] As far as we are aware there has been no previous attempt to build upon the findings of an SR by undertaking a qualitative CIS on the same topic. Each method contributes differently to knowledge of the topic: one by selective assessment of narrowly defined efficacy; the other by exploration of diversity in a broad field. While the heterogeneity of the field undermines the strength of the SR, leading to its non-inclusion in current guidelines, the CIS draws strength from the rich variety of its inputs. This provides visibility of multiple viewpoints in developing theory and modelling the processes of ‘real world’ practice of acupuncturists addressing the clinical problem of PHP.

Contributorship statement

MTC proposed and devised the method, facilitated the literature search, supervised the coding and analysis, and finalised writing of the report. RJC carried out the searches, screened and read the papers, acquired translations, extracted and coded data and created analytical diagrams. CB-J provided methodological guidance, particularly in relation to theoretical visibility and undertook important rigour checks regarding data retrieval and analysis. ST reviewed the paper for plausibility and relevance, particularly of podiatric and educational aspects. All authors were involved in checking data extraction, discussing analysis and synthesis, reviewing drafts of the article, and approved the final version for publication.

Acknowledgements

We would like to thank Ding Renxiang, Arantxa and Ismael Arinas Pellon, and Ella Tighe for their help with translation, and Dr Christopher Wagstaff (University of Birmingham) for internal peer review.

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Figure Legends

Figure 1: Flowchart for selection of papers.

Figure 2: Patchwork of factors influencing approaches.